8. The method in accordance with claim 1, wherein cumene hydroperoxide is decomposed in a non-isothermal manner.

9. The method in accordance with claim 8, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into said decomposition reactor, wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said cumene oxidation product feed stream is continuously introduced into said decomposition reactor at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle stream is continuously introduced into said decomposition reactor at a rate of 0.230 parts by weight per minute.

10. The method in accordance with claim 8, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

11. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in a continuous manner using sulfuric acid as the acidic catalyst in the presence of excess acetone, wherein the acetone is thoroughly mixed with cumene hydroperoxide feedstream and the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

12. The method in accordance with claim 11, wherein cumene hydroperoxide is decomposed in a non-isothermal manner.

13. The method in accordance with claim 12, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

14. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in the presence excess acetone, whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

15. The method in accordance with claim 14, wherein cumene hydroperoxide is decomposed in a non-isothermal manner.

16. The method in accordance with claim 15, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

17. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in the presence of excess acetone in a multiplicity of separate sequential reactors each with a controlled temperature range, whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

18. A method according to claim 17, wherein said cumene hydroperoxide is decomposed in a non-isothermal manner.

19. The method in accordance with claim 18, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

20. The method in accordance with claim 19, wherein a first reactor is operated in a temperature range of about 50°C to about 90°C.

21. The method in accordance with claim 19, wherein the outlet stream of a decomposition reactor is passed into a reactor of plug flow design and smaller size compared to the decomposition reactor wherein the outlet temperature of the plug flow reactor is higher than the inlet temperature of the plug flow reactor.

22. The method in accordance with claim 19, wherein the acidic catalyst is sulfuric acid.

23. The method in accordance with claim 11 wherein the catalyst is in a concentration of from about 30 to 500 ppm of the weight of the reaction mass.

24. The method in accordance with claim 1 wherein the temperature of the cumene hydroperoxide decomposition is about 50 to 90 °C.

25. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in a continuous non-isothermal manner using sulfuric acid as the acidic catalyst in the presence of excess acetone whereby the acetone is thoroughly mixed with cumene hydroperoxide feedstream and the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction wherein the quantity of cumene

hydroperoxide remaining after decomposition is from 0.2 to 3 wt. % of the total weight of the decomposition products whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

26. An improved method for the decomposition of dicumyl peroxide to alpha methyl styrene, phenol and acetone, in the presence of an acidic catalyst wherein the improvement comprises:

(a) carrying out a decomposition of cumene hydroperoxide in the presence of an acidic catalyst and excess acetone to produce phenol, acetone, and dicumyl peroxide,

(b) in a separate vessel, heating the dicumyl peroxide from step (a) to a temperature of greater than 90° C and carrying out the decomposition of dicumyl peroxide in the presence of an acidic catalyst whereby selectivity for alpha methyl styrene is enhanced;

(c) feeding at least a portion of the decomposition products of (b) to a separate vessel wherein acetone is allowed to evaporate; and

(d) recycling at least a portion of the acetone collected from step (c) to the cumene hydroperoxide decomposition of step (a).

27. A composition comprising cumene hydroperoxide, cumene, acidic catalyst for decomposition of cumene hydroperoxide, dicumyl peroxide, dimethylbenzyl alcohol, phenol, and acetone wherein the acetone is in a molar ratio to phenol in excess of 1.

28. The composition in accordance with claim 27, wherein the molar ratio of acetone to phenol in the composition is about 1.4:1.

29. An improved method for preparing phenol and acetone from the decomposition of cumene hydroperoxide with an acidic catalyst wherein the improvement comprises (a) decomposing cumene hydroperoxide in the presence of cumene and at a specific catalyst concentration and temperature whereby a composition comprising phenol, acetone and dicumyl peroxide is formed, (b) transferring dicumyl peroxide to a plug flow reactor wherein decomposition of dicumyl peroxide to phenol, acetone and alphamethylstyrene occurs at a higher temperature than the temperature in step (a) whereby the dicumyl peroxide decomposition is better controlled.

30. The method in accordance with claim 29, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into the decomposition reactor of step (a), wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said cumene oxidation product feed stream is continuously introduced into said decomposition reactor of step (a) at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle stream is continuously introduced into said decomposition reactor of step (a) at a rate of 0.230 parts by weight per minute.

31. An improved method for preparing phenol and acetone from the decomposition of cumene hydroperoxide with an acidic catalyst wherein the improvement comprises:

(a) decomposing cumene hydroperoxide at a specific acidic catalyst concentration and temperature whereby a composition comprising phenol, acetone and dicumyl peroxide is formed,

(b) transferring dicumyl peroxide to a plug flow reactor wherein decomposition of dicumyl peroxide to phenol, acetone and alphamethylstyrene occurs at higher temperature than the temperature in step (a) whereby the dicumyl peroxide decomposition is better controlled, wherein step (a) the temperature is from about 50°-90° C. and the catalyst concentration is from about 30-500 ppm of the decomposition mass and in step (b) the temperature is from about 90° to 150° C.

32. An improved method for maintaining control of an acid catalyzed cumene hydroperoxide decomposition in a multiplicity of sequential reactors wherein the improvement comprises passing a portion of the outlet stream of a back mixed reactor into a reactor of plug flow design and a smaller size compared to the cumene hydroperoxide decomposition reactors wherein the inlet temperature is lower than the outlet temperature of said plug flow reactor whereby the smaller size reactor decomposes essentially all of the cumene hydroperoxide remaining in said portion of the outlet stream and provides an analytical indication of the completeness of the cumene hydroperoxide decomposition reaction and the reactors are thereby controlled.

33. An improved method for enhancing the decomposition of cumene hydroperoxide and producing cumene hydroperoxide decomposition products therefrom wherein the improvement comprises recycling the cumene hydroperoxide decomposition products to a cumene

hydroperoxide feedstream and wherein additional acetone is added to the cumene hydroperoxide decomposition products so as to add 10 to 100 percent acetone relative to the amount of acetone produced during the cumene hydroperoxide decomposition reaction whereby selectivity is higher and safety of the process is improved.

34. The method in accordance with claim 33 wherein additional water is added to the cumene hydroperoxide decomposition products to a level not greater than 4 wt. % in the cumene hydroperoxide decomposition mass.

35. The method in accordance with claim 34 wherein the level is between 0.03 and 1.34 wt %.

36. An improved method for the decomposition of cumene hydroperoxide to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in a decomposition reactor in the presence of cumene and introducing additional water into the cumene hydroperoxide decomposition reactor.

37. A method according to claim 36, wherein said cumene hydroperoxide is decomposed in a non-isothermal manner.

38. The method in accordance with claim 37, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into the decomposition reactor of step (a), wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said

cumene oxidation product feed stream is continuously introduced into said decomposition reactor of step (a) at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle stream is continuously introduced into said decomposition reactor of step (a) at a rate of 0.230 parts by weight per minute.

39. A cumene hydroperoxide decomposition mass produced from the reaction of cumene hydroperoxide with an acid catalyst, wherein the acid catalyst is sulfuric acid, in a continuous manner having 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction and cumene.

40. A method according to claim 39, wherein said cumene hydroperoxide is decomposed in a non-isothermal manner.

41. The composition in accordance with claim 40, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

42. The method in accordance with claim 41, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into a decomposition reactor, wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said cumene oxidation product feed stream is continuously introduced into said decomposition reactor at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle